

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT				1. CONTRACT ID CODE <div style="text-align: center;">J</div>		PAGE OF PAGES <div style="text-align: center;">1 9</div>	
2. AMENDMENT/MODIFICATION NO. <div style="text-align: center;">0003</div>		3. EFFECTIVE DATE <div style="text-align: center;">23-Aug-2005</div>		4. REQUISITION/PURCHASE REQ. NO. <div style="text-align: center;">W16ROE-5193-5926</div>		5. PROJECT NO. (If applicable)	
6. ISSUED BY USA ENGINEER DISTRICT, NEW YORK ATTN: CENAN-CT ROOM 1843 26 FEDERAL PLAZA NEW YORK NY 10278		CODE <div style="text-align: center;">W912DS</div>		7. ADMINISTERED BY (If other than item 6) <div style="text-align: center; font-weight: bold;">See Item 6</div>			
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)				X		9A. AMENDMENT OF SOLICITATION NO. W912DS-05-B-0015	
				X		9B. DATED (SEE ITEM 11) 29-Jul-2005	
						10A. MOD. OF CONTRACT/ORDER NO.	
						10B. DATED (SEE ITEM 13)	
CODE		FACILITY CODE					
11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS							
<input checked="" type="checkbox"/> The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer <input type="checkbox"/> is extended, <input checked="" type="checkbox"/> is not extended. Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning <u>1</u> copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.							
12. ACCOUNTING AND APPROPRIATION DATA (If required)							
13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.							
A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.							
B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).							
C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:							
D. OTHER (Specify type of modification and authority)							
E. IMPORTANT: Contractor <input type="checkbox"/> is not, <input type="checkbox"/> is required to sign this document and return _____ copies to the issuing office.							
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) The purpose of this amendment is to: (i) make changes to the specifications (ii) revise the bid schedule (iii) answer a question for informational purposes only. The Bid Opening date remains unchanged. Note: Bidders must acknowledge receipt of this amendment by the date specified in the solicitation (or as amended) by one of the following methods: In the space provided on the SF1442, by separate letter, or by telegram, or by signing the block 15 below. FAILURE TO ACKNOWLEDGE AMENDMENTS BY THE DATE AND TIME SPECIFIED MAY RESULT IN REJECTION OF YOUR BID IN ACCORDANCE WITH THE LATE BID, LATE MODIFICATIONS OF BIDS OR LATE WITHDRAWAL OF BIDS (FAR 14.304)							
Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.							
15A. NAME AND TITLE OF SIGNER (Type or print)				16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)			
				TEL: _____ EMAIL: _____			
15B. CONTRACTOR/OFFEROR _____ (Signature of person authorized to sign)		15C. DATE SIGNED		16B. UNITED STATES OF AMERICA BY _____ (Signature of Contracting Officer)		16C. DATE SIGNED 23-Aug-2005	

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

SECTION SF 30 - BLOCK 14 CONTINUATION PAGE

The following have been added by full text:

AMENDMENT 0003**Amendment 3**

The purpose of this amendment is to answer questions posed by prospective bidders and to issues any changes to the specifications.

Responses to Bidder's Question (For Informational Purposes Only:

1. **Question:** In regards to drawing C-7, does "compacted soil (silt and clay) material to be free of all stones" refer to topsoil being used for the top 12" of target berms.

Answer: The material that is to be used must meet the Composition Specification 02921 paragraph 2.2.3; also must be free of all stones. All target berm's soil shall be seeded and maintained according to both specification sections 02921 and 02935.

Changes to Drawings:

Drawing C-4A, GRADING PLAN MAINTENANCE FACILITY

Add the following text: "500 GALLON PROPANE TANK AND HIGH PRESSURE PIPING BY OTHERS. CONTRACTOR SHALL PROVIDE PAD FOR LP TANK, PLACED 20 FT FROM NORTH EAST SIDE OF BUILDING, COORDINATE SIZE WITH FT. DRUM LP GAS SUPPLIER."

Drawing U-1

Delete requirement for one of the two 500 Gallon Propane Tank pads.

Changes to Specifications:

1. Issue new Bid Schedule to include:
 - a. Optional vault latrine.
 - b. Optional increase in the size of the multipurpose building to 30'X80' complete with any additional earthwork and any other requirement to make a complete and useable facility, with no additional framing. No additional interior partitioning required. Provide additional mechanical and electrical proportional to building increase. Increase in instructional area to account for change in size.
 - c. Optional increase in the size of the maintenance support facility to 60'X80', with no additional framing. No additional interior partitioning required. Increase in maintenance bay to account for change in size. Provide additional mechanical and electrical proportional to building increase.

d. Optional Well/Septic System/Bathroom:

- i. Bathroom requirements: Install 2 bathrooms and 1 janitor's closet in the maintenance building, each bathroom shall include but not limited to walls, doors, ceiling, lighting, sink, latrine, all plumbing, and accessories to make for a complete and usable facility. Finish work shall match the rest of the facility requirements. Accessories shall include mirror, toilet paper dispenser and paper towel dispenser. The janitor closet shall include a janitor's sink, all plumbing and accessories for the sink.
- ii. Well requirements: Install a well at 150' deep by 6" diameter well casing to service the maintenance building. The well system shall included but not limited to 6" well casing, pump, service line, 5 gallon expansion tank, pressure system, controls, etc to service the 2 bathrooms and janitors closet to make for a complete and usable facility.
- iii. Septic System requirements: Install a septic system in accordance with New York State Building Code to include but not limited to a minimum of a 1000 gallon concrete tank, concrete distribution box, leach field, drain lines, and accessories to make for a complete and usable facility.

2. Specification Section 02921 Paragraph 2.2.2 Off-Site Topsoil

Delete the following sentence: "Additional topsoil shall be obtained from borrow areas indicated."

Replace with the following sentence: "Any topsoil not acquired through the construction of this project shall be purchased offsite of Fort Drum and brought in by the contractor."

3. Add Spec Sections 02521 & 02531 for new optional bid item Well/Septic System/Bathroom.

REVISED BID SCHEDULE

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0001	All work involved in construction FFP of the Defensive Live Fire Range, including all plant, labor and materials complete. PURCHASE REQUEST NUMBER: W16ROE-5193-5926	1	Lump Sum		

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0002	PROJECT PUNCH LIST FFP This line item applies to all punch list items including those identified at the prefinal and final inspections and is above the normal retainage for this item. Offers shall include this amount in the bid price. This amount shall not be changed. *1 *1 This amount shall be retained by the Government in the event the contractor fails to complete punch list items. This amount is separate from liquidated damages to be applied if the contractor fails to complete the work within the time specified in the contract including any extensions.	1	Dollars, U.S.		

\$30,000.00

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0003		1	Dollars, U.S.		
	AS-BUILT DRAWINGS FFP				
	This line item is for as-built drawings per section 00800. (No partial payments will be provided until final acceptance.) Offers should include this amount in the bid price. This amount shall not be changed.				

\$20,000.00

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004 OPTION		1	Lump Sum		
	WETLAND MITIGATION FFP				
	This bid item shall include all costs associated with the mitigation of wetland impacts and installation and removal of one temporary access to the mitigation site. (Optional Item)				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005 OPTION		1	Lump Sum		
	VAULT LATRINE FFP				
	This bid item shall include all costs associated with the construction of one additional field latrine, placed near the maintenance facility, exact location determined by COR.				

NET AMT

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0006 OPTION	OPTIONAL INCREASE IN THE SIZE OF THE FFP MULTIPURPOSE BUILDING TO 30X80. This bid item shall include all costs associated with the increase in size of the multipurpose building.	1	Lump Sum		
NET AMT					

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0007 OPTION	OPTIONAL INCREASE IN THE SIZE OF THE FFP MAINTENANCE SUPPORT FACILITY TO 60X80. This bid item shall include all costs associated with the increase in size of the maintenance support building.	1	Lump Sum		
NET AMT					

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0008 OPTION	OPTIONAL WELL/SEPTIC SYSTEM/BATHROOM FFP This bid item shall include all costs associated with the construction of 2 bathrooms, one janitor closet, a well and a septic system.	1	Lump Sum		
NET AMT					

TOTAL BASE BID (LINE ITEMS 0001 thru 0003)

\$ _____

TOTAL OPTIONAL BID (LINE ITEMS 0004 thru 0008)

\$ _____

TOTAL BID (LINE ITEMS 0001 thru 0008)

\$ _____

NOTES TO BIDDERS:

1. Bidders are reminded that they must bid on the issued plans and specifications as amended. Any deviation, conditions, or attachments made by the bidder himself thereto may render his bid non-responsive and be cause for its rejection.
2. Any bid that is materially unbalanced as to prices for the base bid, including the optional items, may be rejected. An unbalanced bid is one that is based on prices, which are significantly less than the cost of some work and prices overstated for other work.
3. Basis of Award: The low bidder for purposes of award will be the conforming responsible bidder offering the lowest amount for the base bid plus all optional bid items.
4. Bidders are required to bid on the base bid and all optional items or their bids will be rejected.
5. The minimum construction award will be the amount of the base bid items.
6. Line items 0002 and 0003 are pre-priced, firm fixed line items and price shown may not be changed.
7. At any time prior to **120** calendar days after issuance of notice to proceed, the Government at its option, should funds be available, may direct the Contractor, by written order, to perform the work and/or services provided under any of the options. The award of any option is at the sole discretion of the Government.
8. Award of any or all of the Optional Bid items will not extend the contract duration indicated in Section 00800 or elsewhere in the contract documents.

SECTION 00010 - SOLICITATION CONTRACT FORM

CLIN 0005 is added as follows:

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005		1	Lump Sum		
OPTION	VAULT LATRINE FFP This bid item shall include all costs associated with the construction of one additional field latrine, placed near the maintenance facility, exact location determined by COR.				

NET AMT

FOB: Destination

CLIN 0006 is added as follows:

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0006		1	Lump Sum		
OPTION	OPTIONAL INCREASE IN THE SIZE OF THE FFP MULTIPURPOSE BUILDING TO 30X80. This bid item shall include all costs associated with the increase in size of the multipurpose building.				

NET AMT

FOB: Destination

CLIN 0007 is added as follows:

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0007		1	Lump Sum		
OPTION	OPTIONAL INCREASE IN THE SIZE OF THE FFP MAINTENANCE SUPPORT FACILITY TO 60X80. This bid item shall include all costs associated with the increase in size of the maintenance support building.				

NET AMT

FOB: Destination

CLIN 0008 is added as follows:

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0008		1	Lump Sum		
OPTION	OPTIONAL WELL/SEPTIC SYSTEM/BATHROOM FFP This bid item shall include all costs associated with the construction of 2 bathrooms, one janitor closet, a well and a septic system.				

NET AMT

FOB: Destination

(End of Summary of Changes)

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE CONSTRUCTION

SECTION 02521

WATER WELLS

09/03

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
- 1.5 WELL INSTALLATION PLAN
- 1.6 QUALIFICATIONS
- 1.7 ABANDONMENT OF WELLS
- 1.8 NOTIFICATION
- 1.9 DELIVERY, STORAGE, AND HANDLING
- 1.10 SITE CONDITIONS

PART 2 PRODUCTS

- 2.1 CASING
 - 2.1.1 Steel Casing and Couplings
- 2.2 WELL SCREENS
 - 2.2.1 Metal Screen
- 2.3 FILTER PACK
- 2.4 BENTONITE SEAL
- 2.5 CEMENT AND BENTONITE GROUT
 - 2.5.1 Cement Grout
 - 2.5.2 Bentonite Grout
- 2.6 PERMANENT PUMP

PART 3 EXECUTION

- 3.1 PROTECTION OF EXISTING CONDITIONS
- 3.2 WELL CONSTRUCTION
 - 3.2.1 Setting Outer Casing
 - 3.2.2 Temporary Casing
 - 3.2.3 Construction of Inner Casing and Screen
 - 3.2.4 Construction of Filter Pack
 - 3.2.5 Bentonite Seal
 - 3.2.6 Grout Placement
- 3.3 WELL DEVELOPMENT
 - 3.3.1 Jetting
 - 3.3.2 Intermittent Pumping
 - 3.3.3 Surging
 - 3.3.4 Well Development Criteria
- 3.4 TESTS
 - 3.4.1 Capacity Test
 - 3.4.2 Test for Plumbness and Alignment
 - 3.4.3 Test for Quality of Water
 - 3.4.4 Sand Test

Pallet Processing Facility
Fort Drum, New York

- 3.5 INSTALLATION OF PERMANENT PUMP
- 3.6 DISINFECTING
- 3.7 SITE CLEAN-UP
- 3.8 DRILLING WASTE DISPOSAL
- 3.9 WELL DECOMMISSIONING/ABANDONMENT
- 3.10 DOCUMENTATION AND QUALITY CONTROL REPORTS
 - 3.10.1 Borehole Logs
 - 3.10.2 Installation Diagrams
 - 3.10.3 Well Development Records
 - 3.10.4 Well Decommissioning/Abandonment Records
 - 3.10.5 Project Photographs
 - 3.10.6 Survey Maps and Notes

-- End of Section Table of Contents --

SECTION 02521

WATER WELLS
09/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA A100	(1997) Water Wells
AWWA B300	(1999) Hypochlorites
AWWA B301	(2004) Liquid Chlorine
AWWA C206	(1997) Field Welding of Steel Water Pipe
AWWA C654	(2003) Disinfection of Wells
AWWA EWW	(1998) Standard Methods for the Examination of Water and Wastewater

ASTM INTERNATIONAL (ASTM)

ASTM A 53/A 53M	(2004a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM C 150	(2004a) Portland Cement
ASTM D 2488	(2000) Description and Identification of Soils (Visual-Manual Procedure)
ASTM D 4750	(1987; R 2001) Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)
ASTM D 5299	(1999) Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities
ASTM D 5521	(1994e1) Development of Ground-Water Monitoring Wells in Granular Aquifers

NEW YORK STATE DEPARTMENT OF HEALTH (NYSDOH)

Title 10 (Health)	Title 10 (Health) of the Official Compilation of Codes, Rules and Regulations of the State of New York
-------------------	--

Defensive Live Fire Range
Fort Drum, New York

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE TR GL-85-3

(1985) Geotechnical Descriptions of Rock
and Rock Masses

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 600/4-79/020

(1983) Methods for Chemical Analysis of
Water and Wastes

1.2 GENERAL REQUIREMENTS

The well shall be located as shown, and be constructed in accordance with these specifications. Each well shall be installed to prevent aquifer contamination by the drilling operation and equipment, intra- and inter-aquifer contamination, and vertical seepage of surface water adjacent to the well into the subsurface, especially the well intake zone.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES within 15 working days of completion of each item, unless otherwise noted:

SD-02 Shop Drawings

Installation Diagrams.

As-built installation diagram for each well installed, prepared by the geologist present during well installation operations.

SD-03 Product Data

Well Installation Plan; G, RO

A plan as specified in paragraph WELL INSTALLATION PLAN describing the drilling methods, sampling, and well construction and well development 30 calendar days prior to beginning drilling operations. Mobilization activities may start prior to submittal of the plan. The plan shall be approved and signed by an experienced geologist as specified in paragraph QUALIFICATIONS.

Well Material

Catalog data, and name of supplier, for well screens (to include the screen slot size), casing, riser pipe, filter pack material, bentonite, cement, centralizers, surface protective covers, well vaults, locking caps, airline oil filters for pneumatic drilling, dedicated sampling equipment, pumps, and chemical specifications on drill lubricants, tracers, disinfecting agents, and drill fluid additives, if used. Catalog data shall include any information, written or otherwise, supplied by the manufacturers or suppliers of the above listed items.

Qualifications

Personnel qualification documentation.

Site Conditions

A copy of all permits, licenses, or other legal requirements necessary for execution of the work shall be furnished 5 working days before commencement of the work.

SD-06 Test Reports

Survey Maps and Notes

Survey maps and notes, including a tabulated list of all wells and monuments, copies of all field books, maps showing the locations, and elevations of all wells, datum used (e.g. state plane NAD27, NAD83, UTM, etc.), elevation datum, units of measurement, and all computation sheets shall be submitted within 20 working days after completion of the survey. Also, a diagram showing where on the top of the well the elevation was determined by the surveyor.

Well Development Records

A well development record, for each well.

Well Completion Report

A well completion report for each well.

Decommissioning/Abandonment Records

A well decommissioning record, for each well abandoned.

Project Photographs

Before, during, and after completion of the work, the Contractor shall take photographs of each well installation site. Photographs shall also be taken of any rock that is cored at the site.

Filter Pack

Filter pack material test results; sieve and chemical analyses.

Tests.

Test Reports within 24 hours following the conclusion of each test.

SD-07 Certificates

Casing

Cement and Bentonite Grout

Air line and gauge

Drilling mud

Well Screens

Graveling equipment list

Construction of Filter Pack

1.4 QUALITY ASSURANCE

Work shall comply with New York Public Health Law, Appendix 75-A of Part 75 of the Administrative Rules and Regulations contained in Chapter II of Title 10 (Health) of the Official Compilation of Codes, Rules and Regulations of the State of New York. The well system shall be designed and signed by a registered professional engineer. The package shall be submitted to NYSDOH for review and approval prior to start of work.

1.5 WELL INSTALLATION PLAN

The following requirements shall be incorporated into the Contractor's Well Installation Plan and followed in the field. The plan shall include, but shall not be limited to, a discussion of the following:

- a. Description of well drilling methods, and installation procedures, including any temporary casing used, placement of filter pack and seal materials, drill cuttings and fluids disposal, and soil/rock sample disposition.
- b. Description of well construction materials, including well screen, riser pipe, centralizers, air line and gauge, tailpiece (if used), filter pack and filter pack gradation, bentonite or drilling mud, drilling fluid additives (if used), drilling water, cement, and well protective measures.
- c. Description of quality control procedures to be used for placement of filter pack and seals in the boring, including depth measurements.
- d. Forms to be used for written boring logs, installation diagrams of wells, well development records, well sampling data records, state well registration forms, and well abandonment records.
- e. Description of contamination prevention and well materials and equipment decontamination procedures.
- f. Description of protective cover surface completion procedures, including any special design criteria/features relating to frost heave prevention. The maximum frost penetration for the site shall be included in this description.
- g. Description of well development methods to be used.
- h. List of applicable publications, including state and local regulations and standards.
- i. List of personnel assignments for this project, and personnel qualifications.
- j. Description of well decommissioning/abandonment procedures.
- k. Description of well capacity testing techniques.

- l. Description and discussion of geophysical techniques to be employed at the site.
- m. Description of permanent pump to be installed, and discussion of pump operating tests to be employed at the site.
- n. Description of specific methods to be employed to control potential contamination or pollution arising from well installation activities.

1.6 QUALIFICATIONS

A geologist with at least 3 years experience in soil and rock logging, and well installation, registered in the state of New York, shall be on site and responsible for all borehole logging, drilling, well installation, developing and testing activities. The driller shall be licensed and registered in the state of New York, according to the state requirements. The Contractor shall have a minimum of 5 years of well installation experience.

1.7 ABANDONMENT OF WELLS

If the Contractor fails to construct a well of the required capacity, or if the well is abandoned because of loss of tools, or for any other cause, the Contractor shall abandon the hole as specified in paragraph WELL DECOMMISSIONING/ABANDONMENT.

1.8 NOTIFICATION

The Contracting Officer shall be notified 5 days prior to drilling. The Contractor shall be responsible for contacting the State of New York in accordance with the applicable reporting requirements. Before beginning work, the local United States Geological Survey office (USGS) and the State Environmental Protection office shall be notified of the type and location of wells to be constructed, the method of construction and anticipated schedule for construction of the wells.

1.9 DELIVERY, STORAGE, AND HANDLING

Well materials shall be stored and maintained in a clean, uncontaminated condition throughout the course of the project. Filter pack material shall not be allowed to freeze before installation.

1.10 SITE CONDITIONS

Access to well site, including any utility clearance, permits, licenses, or other requirements and the payment thereof necessary for execution of the work, is the responsibility of the Contractor.

PART 2 PRODUCTS

2.1 CASING

All casing, screen, and other well material shall be of compatible materials to prevent galvanic reaction between components of the completed well.

2.1.1 Steel Casing and Couplings

Steel casing shall be new steel pipe, conforming to ASTM A 53/A 53M and shall be nominal 200 mm diameter, 8.4 mm wall thickness, as applicable. Joints shall be either threaded and coupled, or field welded in accordance with AWWA C206. Casings shall be provided with drive shoes.

2.2 WELL SCREENS

Well screens shall be a minimum of 100 mm nominal diameter, and shall be directly connected to the bottom of the inner casing by an approved method.

The length of the screen shall be sufficient to provide an intake area capable of passing not less than the minimum required yield of the well, at an entrance velocity not exceeding 30.5 mm/s. The opening, or slot size of the screen, shall be designed based on analysis of the distribution of the grain size of the aquifer materials encountered during drilling, be compatible with the material surrounding the screen, and shall be submitted for approval as part of the well installation plan. The well screen shall be of sufficient size and design to hold back and support the gravel used in the filter pack envelope and in-situ material surrounding the screen. The screen and all accessories required for satisfactory operation shall be essentially standard products of manufacturers regularly engaged in the production of such equipment. Field constructed screen is not acceptable. "Blanks" in the well screen may be utilized in nonproductive zones, or where centering devices are needed in the screened area, and shall be considered "casing." The bottom section, below the screen, shall be sealed watertight by means of a flush threaded or welded end cap of the same material as the well screen.

2.2.1 Metal Screen

Metal screen shall be of an approved wire-wound type and shall be Type 304 or Type 316 stainless steel, conforming to the applicable requirements of AWWA A100. A wire-wound screen manufactured with supporting bars or core of material different from the wire will not be acceptable. Joints shall be made of threaded couplings of the same material as the screens or by brazing or welding in accordance with AWWA C206.

2.3 FILTER PACK

Filter pack material shall be a product of a commercial sand and gravel supplier, shall be properly sized and graded for the surrounding soil encountered, and shall be composed of clean, round, hard, waterworn siliceous material, free of flat or elongated pieces, organic matter, or other foreign matter. The filter material shall be of a size which will allow the maximum flow of water into the well and prevent the infiltration of sand and silt. The gradation of the filter material shall be such that the uniformity coefficient is not more than 2.5. The filter material shall be thoroughly sterilized with chlorine or hypochlorite immediately before being placed and placed as directed.

2.4 BENTONITE SEAL

The bentonite seal, intended to keep grout from entering the filter pack, shall consist of hydrated granular, or pelletized, sodium montmorillonite furnished in sacks or buckets from a commercial source and shall be free of impurities which adversely impact the water quality. If the bentonite seal is located above any borehole fluid levels, a layer of fine sand shall be placed at the top of the bentonite seal, to provide an additional barrier

to any downward migration of grout.

2.5 CEMENT AND BENTONITE GROUT

2.5.1 Cement Grout

Cement grout shall consist of Portland cement conforming to ASTM C 150, Type I or II, sand and water. Cement grout shall be proportioned not to exceed 2 parts, by weight, of sand to 1 part of cement with not more than 23 liters of water per 42.6 kg of Portland cement, with a mixture of such consistency that the well can be properly grouted. No more than 5 percent by weight of bentonite powder may be added to reduce shrinkage.

2.5.2 Bentonite Grout

High-solids bentonite grout shall be made from sodium bentonite powder and/or granules. Water from an approved source shall be mixed with these powders or granules to form a thick bentonite slurry. The slurry shall consist of a mixture of bentonite and the manufacturer's recommended volume of water to achieve an optimal seal. The slurry shall contain at least 20 percent solids by weight and have a density of 4.3 kg/L of water or greater.

2.6 PERMANENT PUMP

Permanent pump shall be an approved submersible type with a capacity sufficient to deliver 1.89 L/s. The pump shall be connected to the pump controls by a three-wire drop line. Piping for the well drop line shall be galvanized steel pipe conforming to ASTM A 53/A 53M. The pump shall operate on 230 volts, 60 Hz, single-phase power, and the motor shall be of sufficient size to operate the pump under the maximum operating conditions without exceeding its rating. Pump shall be equipped with necessary controls to provide for automatic operation of the pump. The pump and motor unit shall be no larger than 100 mm in diameter at any point.

PART 3 EXECUTION

3.1 PROTECTION OF EXISTING CONDITIONS

The Contractor shall maintain existing survey monuments and wells, and protect them from damage from equipment and vehicular traffic. Any items damaged by the Contractor shall be repaired by the Contractor. Wells requiring replacement due to Contractor negligence shall be re-installed according to these specifications. Wells scheduled for abandonment shall be protected from damage so that abandonment may be performed according to these specifications. Prior to excavation, the Contractor shall obtain written approval from the local utility companies to drill at each site, to avoid disturbing buried utilities.

3.2 WELL CONSTRUCTION

The drilling method shall be as approved by the Contracting Officer and shall conform to all state and local standards for water well construction.

The execution of the work shall be by competent workmen and shall be performed under the direct supervision of an experienced well driller. The drilling method shall prevent the collapse of formation material against the well screen and casing during installation of the well. The inside diameter of any temporary casing used shall be sufficient to allow accurate placement of the screen, riser, centralizer(s), filter pack, seal and grout. Any drilling fluid additive used shall be inorganic in nature, but

be phosphate free. Grease or oil on drill rods, casing, or auger joints are not permitted; however, PTFE tape or vegetable oil (in solid phase form) are acceptable. The drill rig shall be free from leaks of fuel, hydraulic fluid, and oil which may contaminate the borehole, ground surface or drill tools. Casing pipe, well screens, and joint couplings shall be of compatible materials throughout each well. The well shall be a filter pack well activated in the stratum based on test hole data. The well shall be drilled straight, plumb, and circular from top to bottom. The well shall be initially drilled from the ground surface to the uppermost level of the water bearing strata and the bottom of the outer casing set at this elevation. The hole below the outer casing shall penetrate the water bearing stratum a sufficient depth to produce the required amount of water without causing excessive velocities through the aquifer. During construction of the wells, precautions shall be used to prevent tampering with the well or entrance of foreign material. Runoff shall be prevented from entering the well during construction. If there is an interruption in work, such as overnight shutdown or inclement weather, the well opening shall be closed with a watertight uncontaminated cover. The cover shall be secured in place or weighted down so that it cannot be removed except with the aid of the drilling equipment or through the use of drill tools.

3.2.1 Setting Outer Casing

The outer casing shall not be less than 200 mm in diameter. The hole shall be of sufficient size to leave a concentric annular space of not less than 65 mm and not more than 150 mm between the outside of the outer casing and the walls of the hole. The annular space between the outer casing and the walls of the holes shall be filled with cement grout. Acceptable methods of grouting are detailed in AWWA A100; the approved method shall specify the forcing of grout from the bottom of the space to be grouted towards the surface. A suitable grout retainer, packer, or plug shall be provided at the bottom of the inner casing so that grout will not leak into the bottom of the well. Grouting shall be done continuously to ensure that the entire annular space is filled in one operation. After grouting is completed, drilling operations shall not be resumed for at least 72 hours to allow proper setting of the grout.

3.2.2 Temporary Casing

Temporary well casing of either iron or steel of sufficient length to case to the bottom of all borings shall be available at the construction site. The Contracting Officer will direct the use of a temporary casing to the bottom of the boring during drilling and placement of screen, riser, and filter pack when he believes it is necessary to provide adequate support to the sides of the hole. When the walls of the boring will require support only during development operations a temporary casing will be required to extend only to a depth 1 m below the top of the filter pack. The temporary casing, shall have an inside diameter of not less than 200 mm, shall have sufficient thickness to retain its shape and maintain a true section throughout its depth, and may be in sections of any convenient length. The temporary casing shall be such as to permit its removal without disturbing the filter pack, riser, or well screen. The setting of temporary casing shall be such that no cavity will be created outside of it at any point along its length. In the event the temporary casing should become unduly distorted or bent it should be discarded and a new casing should be used during installation of any additional well.

3.2.3 Construction of Inner Casing and Screen

After the grout has set, the hole below the outer casing shall be reamed at the required diameter, to the required depth, by an approved method which will prevent caving of the hole before or during installation of the filter pack, well screen and inner casing. In lieu of reaming, the entire well may be drilled to the diameter of the filter pack with an annular space between the inner casing and outer casing equal to the thickness of the filter pack. The outer casing shall be increased in size to provide for this space, if this option is elected. The well screen and inner casing shall be firmly attached, and lowered into the hole by a method which will allow for control of the rate of fall of the well screen and inner casing at all times. Well screen and inner casing shall not be dropped or allowed to fall uncontrolled into the hole. The inner casing shall extend up through the outer casing to 0.46 meters above the ground surface. Approved centering devices shall be installed at a spacing of 120 degrees, between the outer casing and inner casing prior to well construction at intervals not exceeding 8 meters along the length or the top of the inner casing and the bottom of the outer casing. If the screen length is greater than 8 meters, a 1 meter length of blank casing shall be placed in the middle of the screen interval for placement of centering devices. Centering devices shall not be placed on the screened interval, or within the bentonite seal, if used.

3.2.4 Construction of Filter Pack

After the screen and inner casing have been concentrically set in the hole below the outer casing, the approved filter pack shall be constructed around the screen by filling the entire space between the screen and the wall of the hole in the water bearing stratum with filter pack material. A tremie pipe having an inside nominal diameter of not less than 40 mm shall be lowered to the bottom of the well between the hole and screen. The tremie pipe shall be arranged and connected, at the surface of the ground, to water pumping and graveling equipment so that water and filter material, fed at uniform rates, are discharged as the filter material fills the hole from the bottom up. The tremie pipe shall be raised at a rate that will keep the bottom of the pipe no more than 1 m above the filter material level at all times. If the Contractor desires to use methods of placing filter material other than those specified, the details of the method and equipment proposed shall be submitted to the Contracting Officer, before filter pack placement is begun; however, dumping filter pack material from the surface of the ground and agitating the well in an effort to settle the filter will not be allowed. The filter pack shall be installed continuously and without interruption until the filter pack has been placed to within 6 m above the top of the screen. The depth to the top of the filter pack shall be directly measured, and recorded. Any water added to the filter pack material shall be obtained in accordance with paragraph Water Source. Filter pack material shall be protected from contamination prior to placement by either storing it in plastic lined bags, or in a location protected from the weather and contamination on plastic sheeting. Filter pack material shall not be allowed to freeze before installation. Filter pack material shall be transported to the well site in a manner which prevents contamination by other soils, oils, grease, and other chemicals. Temporary drill casing, if installed, or hollow stem auger, shall be removed simultaneously with the above operation. Filter pack material shall be placed in no greater than 1 m lifts prior to retraction of the temporary casing/auger. A minimum of 150 mm of filter pack shall remain in the temporary casing/auger at all times during filter pack installation. Frequent measurements shall be made inside the annulus

during retraction to ensure that the filter pack is properly placed.

3.2.5 Bentonite Seal

After the inner casing and well screen and filter pack have been installed, and after predevelopment of the well, the annular space between the inner and outer casings shall be sealed by use of a bentonite seal. A minimum 1 m thick hydrated bentonite seal shall be placed on top of the filter pack in a manner which prevents bridging of the bentonite in the annulus. The bottom of the bentonite seal shall be a minimum of 2 m above the top of the well screen. The depth to the top of the bentonite seal shall be directly measured, and recorded immediately after placement, without allowance for swelling. If the bentonite seal is located above any borehole fluid levels, a 300 mm layer of fine sand shall be placed at the top of the bentonite seal.

3.2.6 Grout Placement

After the inner casing and well screen and filter pack have been installed, a non-shrinking cement or high-solids bentonite grout, shall be mechanically mixed in accordance with paragraph CEMENT AND BENTONITE GROUT, and placed by tremie pipe, in one continuous operation into the annulus between the inner and outer casings above the bentonite seal to within 150 mm of the ground surface. Grout injection shall be in accordance with AWWA A100. If the casing interval to be grouted is less than 4.5 m, and without fluids after any drill casing is removed, the grout may be placed either by pouring or pumping. The tremie pipe shall be thoroughly cleaned with high pressure hot water/steam before use in each well. The bottom of the tremie pipe shall be constructed to direct the discharge to the sides rather than downward. The discharge end of the tremie pipe shall be submerged at all times. Additional grout shall be added from the surface to maintain the level of the grout at the land surface as settlement occurs. Work shall not be conducted in the well within 24 hours after cement grouting. The alignment of the well shall be verified by passing a 1.5 m long section of rigid PVC, stainless steel, or PTFE pipe 6 mm smaller in diameter than the inside diameter of the casing through the entire well. If the pipe does not pass freely, the well will not be accepted. The pipe section shall be thoroughly cleaned with high pressure hot water/steam prior to each test.

3.3 WELL DEVELOPMENT

Within 7 days of completion of each well, but no sooner than 48 hours after cement grouting is completed, the well shall be developed. Predevelopment, or development after the filter pack has been installed, but before the annular seal is installed, may be initiated before this minimum 48 hour period. The well shall be developed in accordance with the Well Installation Plan, by approved methods until the water pumped from the well is substantially free from sand, and until the turbidity is less than 0.5 NTU. Developing equipment shall be of an approved type and of sufficient capacity to remove all cutting fluids, sand, rock cuttings, and any other foreign material. The well shall be thoroughly cleaned from top to bottom before beginning the well tests. Development shall be performed using only mechanical surging, over pumping, or jetting, or a combination thereof per ASTM D 5521. Details of the proposed development method shall be included in the Well Installation Plan. At the time of development of any well, the well shall be free of drawdown or surcharge effects due to pump testing, developing or drilling at another location. The Contractor shall be responsible for maintaining at the well site the needed access and work area and clearance, necessary to accomplish development. The Contractor

shall furnish, install, or construct the necessary discharge line and troughs to conduct and dispose of the discharge a sufficient distance from the work areas to prevent damage. Development shall be conducted to achieve a stable well of maximum efficiency and shall be continued until a satisfactory sand test, as specified in paragraph Sand Test, is obtained. During predevelopment of the well, filter pack material shall be added to the annular space around the screen to maintain the top elevation of the filter pack to the specified elevation. The Contractor shall provide an open tube or other approved means for accurately determining the water level in the well under all conditions. If, at any time during the development process it becomes apparent in the opinion of the Contracting Officer that the well may be damaged, development operations shall be immediately terminated. The Contracting Officer may require a change in method if the method selected does not accomplish the desired results. The Contracting Officer may order that wells which continue to produce excessive amounts of fines after development for 6 hours be abandoned, plugged, and backfilled, and may require the Contractor to construct new wells nearby. All materials pulled into the well by the development process shall be removed prior to performing the pumping test.

3.3.1 Jetting

Jetting should be performed using either a single or double ring jet. If a double ring jet is used the rings should be 600 mm apart. The jetting tool shall be constructed of high-strength material and conservatively designed and proportioned so that it will withstand high pressures. The jetting tool shall have two 7 to 8 mm diameter hydraulically balanced nozzles spaced 180 degrees or four 7 to 8 mm diameter holes spaced 90 degrees apart and which shall exert the jetting force horizontally through the screen slots. The rings shall be constructed such that the tips of the jets shall be within 13 mm from the inner surface of the well screen. The pump used in conjunction with the jetting tool shall be capable of providing pressures up to 1700 kPa or a minimum jetting fluid exit velocity of 45 m/s.

Prior to commencing jetting, and following each jetting cycle, all sand and/or other materials shall be removed from inside the screen. The jetting process shall start at the bottom of the screen and consist of rotating the jetting tool slowly while rotating the pipe 180 degrees for two minutes at each location then raising the pipe 150 mm. All wells, more than 100 mm in diameter, shall be pumped during the jetting cycle to remove incoming sand and other material. Such pumping shall be at a rate not less than 115 percent of the rate at which fluid is introduced through the jetting tool. This will allow a flow of material into the well as it is being developed. Water used for development shall be free of sand. The contracting officer may require other means of developing the well such as intermittent pumping method, variation of the intermittent pumping method, or surge block if it appears that the development of the well is not producing the desired results.

3.3.2 Intermittent Pumping

Intermittent pumping shall be performed by pumping the well at a capacity equivalent to pump demand to produce a rapid drawdown stopping the pump (backflow through pump will not be permitted) to permit the water surface to rise to its former elevation, and repeating this procedure. Cycle time for this procedure will vary as directed but will not be more than 3 cycles per minute. A pump discharge in excess of 25 L/s will be required. A deep well turbine pump, or electric submersible pump with check valve, shall be used with any attachment necessary to accomplish rapid starting and stopping for intermittent pumping. The intake shall be set at least 3 m

below the maximum expected drawdown in the well. Prior to commencing intermittent pumping, and periodically during development by this method, all sand and/or other materials shall be removed from inside the screen. The amount of drawdown may be decreased if, in the opinion of the Contracting Officer, the efficiency of the well might otherwise be impaired.

3.3.3 Surging

Surging of the well shall require use of a circular block, or multiple blocks, which are approximately 25 mm smaller in diameter than the inside diameter of the well and is constructed of a material which will not damage the screen if the block comes in contact with the screen, and a bailer or pump to remove materials drawn into the well. The surging shall be continued for a period of approximately one hour, or until little or no additional material from the foundation or filter pack can be pulled through the screen. The surge block shall be moved by a steady motion up and down the full length of the well screen. Prior to commencing surging, and periodically during development by this method, all sand and/or other materials shall be removed from inside the screen. All materials pulled into the well by the surging process shall be removed by the Contractor.

3.3.4 Well Development Criteria

A well development record shall be maintained in accordance with paragraph Well Development Records. Development is complete when all of the following criteria are met:

- a. Well water is clear to the unaided eye ,and turbidity less than or equal to 5 Nephelometric Turbidity Units (NTUs),
- b. Sediment thickness in the well is less than 1 percent of the screen length or 30 mm,
- c. A minimum of three times the standing water volume in the well is removed plus three times the volume of all added water and drilling fluid lost during drilling and installation of the well is removed, and
- d. Temperature, specific conductivity, pH,oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity readings, measured before, twice during and after development operations, have stabilized. Stabilization shall mean variation of less than 0.2 pH units, variation of plus or minus ± 0.5 degree Celsius, ± 3 percent change in specific conductance; and less than a ± 10 mV for ORP; and ± 10 percent for DO, and turbidity, measured between three consecutive readings with one casing volume of water removed between each reading. ORP shall be determined in accordance with AWWA EWW. Temperature, specific conductance, DO, turbidity, and pH readings shall be conducted in accordance with EPA 600/4-79/020. At completion of well development, approximately 0.5 liter of well water shall be collected in a clear glass jar. The jar shall be labeled with project name, well number and date; and photographed using 35 mm color print film. The photograph (minimally 125 x 174 mm) shall be a suitably backlit close-up which shows the clarity of the water and any suspended sediment. The photograph and negative shall become a part of the well development record. Water removed during development and testing operations shall be discharged to the ground surface at least 25 meters from the well in a down gradient area.

3.4 TESTS

Well tests shall be performed in the Public Works Water Shop. After the wells have been developed, the Contractor shall notify the Government and shall make the necessary arrangements for conducting the capacity tests. If the capacity test indicates that the required capacity can be obtained, the tests for quality of water shall be made. If the capacity and quality tests indicate that the required capacity and quality can be obtained, the permanent well, as specified, shall be completed at that depth. Prior to making quality tests, drilling equipment, tools and pumps contacting well water shall be cleaned with live steam.

3.4.1 Capacity Test

The Contractor shall furnish and install an approved temporary test pump, with discharge piping of sufficient size and length to conduct the water being pumped to point of discharge, and equipment necessary for measuring the rate of flow and water level in the well. A 72 hour constant-rate or step-drawdown capacity test shall be run with the pumping rate and drawdown at the pump well recorded every 30 minutes or 1/2 minute during the first 5 minutes after starting the pump; then every 5 minutes for an hour; then every 20 minutes for 2 hours. From this point on, readings taken at hourly intervals, until the water level stabilizes, shall be sufficient. During the step-drawdown test, the pumping rate shall be increased in steps at regular intervals. Specific capacity shall be measured for each step. The test shall begin at the rate of the expected capacity of well and at least that rate maintained throughout the duration of the step interval. The well shall be "step" tested at rates of approximately 1/2, 3/4, 1 and 1 1/2 times the design capacity of 1.89 L/s. If this capacity cannot be maintained for the test period, the capacity test shall be terminated and the test hole drilled deeper or relocated as directed. When the pump is shut off, water level readings shall be taken during the rebound period for the same intervals of time as the drawdown test. The record of the test, in triplicate, shall be delivered to the Contracting Officer.

3.4.2 Test for Plumbness and Alignment

Upon completion of the permanent well, plumbness and alignment shall be tested by lowering into the well, to the total depth of the well, a plumb 12 m long or a dummy of the same length. The outer diameter of the plumb shall not be more than 13 mm smaller than the diameter of that part of the hole being tested. If a dummy is used, it shall consist of a rigid spindle with three rings, each ring being 300 mm wide. The rings shall be cylindrical and shall be spaced one at each end of the dummy and one in the center. The central member of the dummy shall be rigid so that it will maintain the alignment of the axis of the rings. The dummy shall be decontaminated as specified in paragraph Decontamination, before use. If the plumb or dummy fail to move freely throughout the length of the casing or well screen for the depth of well or should the well vary from the vertical in excess of two-thirds the inside diameter of that part of the well being tested for each 30 m of depth, the plumbness and alignment of the well shall be corrected by the Contractor. If the faulty alignment and plumbness is not correctable, as determined by the Contracting Officer, the well shall be abandoned as specified in paragraph WELL DECOMMISSIONING/ABANDONMENT and a new well drilled at no additional cost to the Government.

3.4.3 Test for Quality of Water

After the yield in the permanent well and drawdown test or capacity test have been completed, the Contractor shall secure samples of the water in suitable containers, and of sufficient quantity, to have bacterial, physical, and chemical analyses made by a state-certified testing laboratory. Water Quality Analysis shall address each item specified in the Water Quality Analysis Table at the end of this section. Expenses incident to these analyses shall be borne by the Contractor and the results of the analyses shall be furnished to the Contracting Officer. All sampling and analyses shall be performed using EPA and State approved methods, procedures, and holding times.

3.4.4 Sand Test

As part of each capacity test, or at the end of each intermittent pumping, a determination of the amount of sand (filter pack and/or foundation material) a well is producing shall be performed. Prior to starting the sand test all material shall be removed from the bottom of the tailpipe. The Contractor shall test each well by pumping at a rate of 1.26 - 12.62 L/s.

After the pump is at the desired pumping rate the flow from the discharge shall be diverted into a container that will collect all the sand being carried by the water or through a Rossum Sand Tester. Development of the well is satisfactory if the amount of sand collected is less than 0.5 L per 100,000 L of water pumped at the specified rate. Upon completion of the test the amount of sand in the tailpipe shall be determined to verify that no material is being deposited in the bottom of the well.

3.5 INSTALLATION OF PERMANENT PUMP

The permanent well pump shall be installed in the well at a minimum depth of 8 m below the maximum drawdown groundwater level after the drawdown test has been completed. The pump shall be secured at the required elevation as recommended by the pump manufacturer. After installation of the pumping units and appurtenances is complete, operating tests shall be carried out to assure that the pumping installation operates properly. Tests shall assure that the pumping units and appurtenances have been installed correctly, that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly.

3.6 DISINFECTING

After completion of tests of well, or installation of permanent pump, or at time of tests for yield and drawdown test, whichever is later, the wells shall be disinfected by adding chlorine, conforming to AWWA B301, or hypochlorite, conforming to AWWA B300, in sufficient quantity so that a concentration of at least 50 ppm of chlorine shall be obtained in all parts of the well. Chlorine solution shall be prepared and introduced into the well in an approved manner and shall remain in the well for period of at least 12 hours but not more than 24 hours. Information on methods for preparing chlorine solution and introducing it into the well may be found in AWWA C654. After the contact period, the well shall be pumped until the residual chlorine content is not greater than 1.0 ppm. The well shall be pumped to waste for an additional 15 minutes with less than 1 ppm chlorine residual after which two samples shall be taken not less than 30 minutes apart and tested for the presence of coliform bacteria. The well shall be disinfected and redisinfecting as may be required until two consecutive samples of water are found upon test to be free from Coli Aerogenes group of organisms.

3.7 SITE CLEAN-UP

After completion of the work, tools, appliances, surplus materials, temporary drainage, rubbish, and debris incidental to work shall be removed. Excavation and vehicular ruts shall be backfilled and dressed to conform with the existing landscape. Utilities, structures, roads, fences, or any other pre-existing item which must be repaired or replaced due to the Contractor's negligence shall be the Contractor's responsibility; repair or replacement shall be accomplished prior to completion of this contract.

3.8 DRILLING WASTE DISPOSAL

Slurry, drill cuttings, rock core; other solid or liquid material bailed, pumped, or otherwise removed from the borehole during drilling, installation, completion, and well development procedures; and fluids from material/equipment decontamination activities shall be disposed of by the Contractor.

3.9 WELL DECOMMISSIONING/ABANDONMENT

Any well disapproved by the Contracting Officer, or any well decommissioned/abandoned by the Contractor for any reason shall be decommissioned/abandoned according to the environmental requirements of the State of New York, ASTM D 5299, and the requirements of these specifications. Well decommissioning/abandonment shall be coordinated through Fort Drum Public Works Environmental Division. Well decommissioning/abandonment includes the removal of all materials left in the borehole/well, excluding the filter pack, and including backfill materials, casing, screen, and any other material placed into the hole before the decision was made to abandon the borehole/well. Test holes decommissioned/abandoned for any reason shall be grouted from the bottom to within 7620 mm of the top of the ground surface according to the protocol for grout/bentonite placement established in paragraph Grout Placement, using the grout mix specified in paragraph CEMENT AND BENTONITE GROUT. The top 7620 mm shall be backfilled with material appropriate for the intended land use. The Contractor shall maintain a well decommissioning/abandonment record as specified in paragraph Well Decommissioning/Abandonment Records. Groundwater levels, if encountered before the decision is made for decommissioning/abandonment, shall be measured in all borings prior to backfilling. These water levels shall be included in the well decommissioning/abandonment records. No well shall be decommissioned/abandoned without the approval of the Contracting Officer.

3.10 DOCUMENTATION AND QUALITY CONTROL REPORTS

The Contractor shall establish and maintain documentation and quality control reports for well construction and development to record the desired information and to assure compliance with contract requirements, including, but not limited to, the following:

3.10.1 Borehole Logs

A borehole log shall be completed for each boring drilled. Borehole logs shall be prepared by the geologist present onsite during all well drilling and installation activities. The log scale shall be 10 mm equals 300 mm. Copies of complete well logs shall be kept current in the field at each well site and shall be available at all times for inspection by the

Contracting Officer. Information provided on the logs shall include, but not be limited to, the following:

- a. Name of the project and site.
- b. Boring/well identification number.
- c. Location of boring (coordinates, if available).
- d. Make and manufacturer's model designation of drilling equipment and name of drilling firm.
- e. Date boring was drilled.
- f. Reference data for all depth measurements.
- g. Name of driller and name and signature of geologist preparing log.
- h. Nominal hole diameter and depth at which hole diameter changes.
- i. Total depth of boring.
- j. Method of drilling, including sampling methods and sample depths, including those attempted with no recovery. Indication of penetration resistance such as drive hammer blows given in blows per 150 mm of driven sample tubes. Information shall include hammer weight and drop distance. Information such as rod size, bit type, pump type, etc., shall be recorded. A description of any temporary casing used, drill fluids and fluid additives used, if any, including brand name and amount used, along with the reason for and start (by depth) of its use shall be included. If measured, mud viscosities and weight shall be recorded.
- k. Depth of each change of stratum. If location of strata change is approximate, it shall be so stated.
- l. Description of the material of which each stratum is composed, in accordance with ASTM D 2488, and/or standard rock nomenclature in accordance with COE TR GL-85-3, as necessary. Soil parameters for logging shall include, but shall not be limited to, classification, depositional environment and formation, if known, Unified Soil Classification Symbol, secondary components and estimated percentages, color, plasticity, consistency (cohesive soil), density (non-cohesive soil), moisture content, structure and orientation, and grain angularity. Rock core parameters for logging shall include, but shall not be limited to, rock type, formation, modifier denoting variety (shaly, calcareous, siliceous, etc.), color, hardness, degree of cementation, texture, crystalline structure and orientation, degree of weathering, solution or void conditions, primary and secondary permeability, and lost core. The results of any chemical field screening shall also be included on the boring log. Classification shall be prepared in the field at the time of sampling. The results of visual observation of the material encountered, and any unusual odor detected shall also be duly noted and recorded.
- m. Depth of any observed fractures, weathered zones, or any abnormalities encountered.

- n. Depth and estimated percent of drill fluid loss or lost circulation. Measures taken to regain drill water circulation. Significant color changes in the drilling fluid return.
- o. Depth to water, and any non-aqueous phase liquids (NAPLs) and date measured before, during, and after each drilling shift, and prior to well installation. The Contractor shall provide and maintain at each well under construction a portable water ,and NAPL level measuring device of sufficient length to measure the water /NAPL level to 50 meter depth. The device shall be available onsite at all times and measuring wire shall be graduated in mm. The method of measuring the liquid level shall be noted on the boring log. Water and NAPL level measurements shall be taken to the nearest mm. It shall be noted on the boring log if the boring was purged and allowed to recover at intervals during the installation, or that water used in drilling was allowed to dissipate into the formation prior to measuring the water level.
- p. Box or sample number. Depths and the number of the core boxes and/or samples shall be recorded at the proper interval.
- q. Percent Rock Core Recovery. The percent core recovery for the individual drill runs, if rock is cored, shall be shown.

3.10.2 Installation Diagrams

The well will not be accepted before the geologic logs and installation diagrams are received. The diagram shall illustrate the as-built condition of the well and include, but not be limited to, the following items:

- a. Name of the project and site.
- b. Well identification number.
- c. Name of driller and name and signature of the geologist preparing diagram.
- d. Date of well installation.
- e. Description of material from which the well is constructed, including well casing/riser pipe and screen material, centralizer composition, if used, diameter and schedule of casing and screen, gradation of filter pack, lithologic description, brand name (if any), source, and processing method, and method of placement of the filter pack, bentonite seal type (pellets, granules, chips, or slurry), grout type (cement or high-solids bentonite) and type of protective cover (protective casing or flush-to-ground),if used.
- f. Total depth of well.
- g. Nominal hole diameter.
- h. Depth to top and bottom of screen, and filter pack.
- i. Depth to top and bottom of any seals installed in the well boring (grout or bentonite).
- j. Type of cement and/or bentonite used, mix ratios of grout, method of placement and quantities used.

- k. Elevations/depths/heights of key features of the well, such as top of well casing/riser pipe, top and bottom of protective casing (if used), ground surface, the depth of maximum frost penetration (frost line), bottom of well screen, top and bottom of filter pack, and top and bottom of seal.
- l. Other pertinent construction details, such as slot size and percent open area of screen, type of screen, and manufacturer of screen.
- m. Well location by coordinates. A plan sheet shall also be included showing the coordinate system used and the location of each well. A plan sheet is not required for each well installation diagram; multiple wells may be shown on the same sheet.
- n. Static water level upon completion of the well.
- o. Special problems and their resolutions; e.g., grout in wells, lost casing, or screens, bridging, etc.
- p. Description of surface completion.

3.10.3 Well Development Records

A well development record shall be prepared for each well installed under the supervision of the geologist present during well installation operations. Information provided on the well development record shall include, but not be limited to, the following:

- a. Date, time, and elevation of water level in the well, before development.
- b. Depth to bottom of well, name of project and site, well identification number, and date of development.
- c. Method used for development, to include size, type and make of equipment, bailer, and/or pump used during development.
- d. Time spent developing the well by each method, to include typical pumping rate, if pump is used in development.
- e. Volume and physical character of water removed, to include changes during development in clarity, color, particulates, and odor.
- f. Volume of water added to the well, if any.
- g. Volume and physical character of sediment removed, to include changes during development in color, and odor.
- h. Source of any water added to the well.
- i. Clarity of water before, during, and after development. Nephelometric turbidity unit (NTU) measurements.
- j. Total depth of well and the static water level as per ASTM D 4750 from top of the casing, immediately after pumping/development, and 24 hours after development.

Defensive Live Fire Range
Fort Drum, New York

- k. Readings of pH, specific conductance, DO, ORP, and temperature taken before, during, and after development.
- l. Name and job title of individual developing well.
- m. Name and/or description of the disposal facility/area, for the waters removed during development.

3.10.4 Well Decommissioning/Abandonment Records

Decommissioning/abandonment records shall include, as a minimum, the following:

- a. Project name.
- b. Well or test hole number.
- c. Well/boring location, depth and diameter.
- d. Date of decommissioning/abandonment.
- e. Method of decommissioning/abandonment.
- f. All materials used in the decommissioning/abandonment procedure and the interval in which test materials were placed.
- g. Casing, and or other items left in hole by depth, description, and composition.
- h. Description and total quantity of grout used initially.
- i. Description and daily quantities of grout used to compensate for settlement.
- j. Water or mud level (specify) prior to grouting and date measured.
- k. The reason for decommissioning/abandonment of the well/test hole.

3.10.5 Project Photographs

Before, during, and after completion of work, the Contractor shall take a minimum of one view of each well installation. If rock is cored at the site, after the core has been logged, the core shall be dampened, if it has dried, neatly arranged in the core box, and photographed. Photographs shall be 80 x 120 mm color prints. The photographs shall be mounted and enclosed back-to-back in a double face clear plastic sleeve punched to fit standard three ring binders. Each color print shall show an information box, 20 x 50 mm. The box shall be typewritten and arranged as follows:

Project No.

Contract No.

Contractor/Photographer:

Photograph No.

Date/Time:

Description:

Direction of View:

3.10.6 Survey Maps and Notes

A tabulated list of all wells and monuments, copies of all field books, maps showing the locations, and elevations of all wells, datum used (e.g. state plane NAD27, NAD83, UTM, etc.), elevation datum, units of measurement, and all computation sheets shall be prepared as a submittal. The tabulation shall consist of the designated number of the well or monument, the X and Y coordinates, and all the required elevations. Also, a diagram showing where on the top of the well the elevation was determined by the surveyor shall be prepared.

WATER QUALITY ANALYSIS TABLE

Physical Characteristics

Color	Resistivity in ohms per cubic
Taste	centimeter and 25 degrees C.
Threshold odor number	pH value
Turbidity	Temperature

Chemical Characteristics (Expressed as mg/L)

Arsenic	Total Hardness as CaCO(3)
Barium	Endrin
Cadmium	Lindane
Chromium	Methoxychlor
Copper	Toxaphene
Lead	2-4-D
Mercury	2, 4, 5 TP Silvex
Selenium	Total Organic Halogens
Silver	TOC
Zinc	Sulphates as SO(4)
Fluoride as F	Chlorides as Cl
Manganese as Mn (dissolved and total)	Bicarbonates as HCO(3)
Iron as Fe (dissolved and total)	Carbonates as CO(3)
Suspended Solids	Nitrates as NO(3)
Total Dissolved Solids	Alkalinity (methyl-orange)
Calcium as Ca	(Phenolphthalein) as CaCO(3)
Magnesium as Mg	Silica as SiO(2)
Sodium and Potassium as Na	Radon

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE CONSTRUCTION

SECTION 02531

SANITARY SEWERS

10/04

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 Sanitary Sewer Gravity Pipeline
- 1.3 GENERAL REQUIREMENTS
- 1.4 SUBMITTALS
- 1.5 QUALITY ASSURANCE
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - 1.6.1 Delivery and Storage
 - 1.6.1.1 Piping
 - 1.6.1.2 Metal Items
 - 1.6.1.3 Cement, Aggregate, and Reinforcement
 - 1.6.2 Handling
- 1.7 DRAWINGS
- 1.8 EXISTING CONDITIONS
- 1.9 INSTALLER QUALIFICATIONS

PART 2 PRODUCTS

- 2.1 DISTRIBUTION BOX
- 2.2 SEPTIC TANK
 - 2.2.1 Concrete Tanks
- 2.3 PIPELINE MATERIALS
 - 2.3.1 Ductile Iron Gravity Sewer Pipe and Associated Fittings
 - 2.3.1.1 Ductile Iron Gravity Pipe and Fittings
 - 2.3.1.2 Ductile Iron Gravity Joints and Jointing Materials
 - 2.3.2 ABS Composite Plastic Piping
 - 2.3.2.1 ABS Composite Plastic Pipe and Fittings
 - 2.3.2.2 Jointing Materials for ABS Composite Plastic Piping
 - 2.3.3 ABS Solid-Wall Plastic Piping
 - 2.3.3.1 ABS Solid-Wall Plastic Pipe and Fittings
 - 2.3.3.2 ABS Solid-Wall Plastic Joints and Jointing Materials
 - 2.3.4 PVC Plastic Gravity Sewer Piping
 - 2.3.4.1 PVC Plastic Gravity Pipe and Fittings
 - 2.3.4.2 PVC Plastic Gravity Joints and Jointing Material
- 2.4 CONCRETE MATERIALS
 - 2.4.1 Cement Mortar
 - 2.4.2 Portland Cement
 - 2.4.3 Portland Cement Concrete
- 2.5 MISCELLANEOUS MATERIALS
 - 2.5.1 Metal Items
 - 2.5.1.1 Septic Tank Piping
 - 2.5.2 Sewage Absorption Field Materials
- 2.6 REPORTS

PART 3 EXECUTION

- 3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION
 - 3.1.1 General Requirements for Installation of Pipelines
 - 3.1.1.1 Location
 - 3.1.1.2 Earthwork
 - 3.1.1.3 Pipe Laying and Jointing
 - 3.1.2 Special Requirements
 - 3.1.2.1 Installation of Ductile Iron Gravity Sewer Pipe
 - 3.1.2.2 Installation of ABS Composite Plastic Piping
 - 3.1.2.3 Installation of ABS Solid-Wall Plastic Piping
 - 3.1.2.4 Installation of PVC Plastic Piping
 - 3.1.3 Concrete Work
 - 3.1.4 Miscellaneous Construction and Installation
 - 3.1.4.1 Metal Work
 - 3.1.5 Absorption Trenches
- 3.2 FIELD QUALITY CONTROL
 - 3.2.1 Field Tests and Inspections
 - 3.2.2 Tests for Nonpressure Lines
 - 3.2.2.1 Leakage Tests

-- End of Section Table of Contents --

SECTION 02531

SANITARY SEWERS
10/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C153	(2000) Ductile-Iron Compact Fittings for Water Service
AWWA C600	(1999) Installation of Ductile-Iron Water Mains and Their Appurtenances

ASTM INTERNATIONAL (ASTM)

ASTM A 746	(2003) Ductile Iron Gravity Sewer Pipe
ASTM C 150	(2004a) Portland Cement
ASTM C 270	(2004a) Mortar for Unit Masonry
ASTM C 924M	(2002) Testing Concrete Pipe Sewer Liner by Low-Pressure Air Test Method (Metric)
ASTM C 94/C 94M	(2004a) Ready-Mixed Concrete
ASTM C 969M	(2002) Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric)
ASTM D 1784	(2003) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2235	(2004) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings

ASTM D 2321	(2000) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2680	(2001) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2751	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 3034	(2004) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a; R 2003) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F 402	(1993; R 1999) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	(2002e1) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 949	(2003) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

NEW YORK STATE DEPARTMENT OF HEALTH (NYSDOH)

Title 10 (Health)	Title 10 (Health) of the Official Compilation of Codes, Rules and Regulations of the State of New York
-------------------	--

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6	(1998) Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe
---------------	--

1.2 SYSTEM DESCRIPTION

1.2.1 Sanitary Sewer Gravity Pipeline

Provide building connections of acrylonitrile-butadiene-styrene (ABS) solid-wall plastic pipe or polyvinyl chloride (PVC) plastic pipe at the Contractor's option. Provide new exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 1.5 m outside of building walls.

1.3 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 1.5 m outside the building to which the sewer system is to be connected. The

Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Backfilling shall be accomplished after inspection by the Contracting Officer. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Existing Conditions

Drawings of existing conditions, as specified.

SD-02 Shop Drawings

Drawings

Installation and As-Built drawings, as specified.

Metal items
Septic tank
Distribution box

Details, as specified.

SD-03 Product Data

Pipeline materials

Submit manufacturer's standard drawings or catalog cuts.

SD-06 Test Reports

Reports

Test and inspection reports, as specified.

SD-07 Certificates

Portland Cement

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

1.5 QUALITY ASSURANCE

Work shall comply with New York Public Health Law, Appendix 75-A of Part 75 of the Administrative Rules and Regulations contained in Chapter II of Title 10 (Health) of the Official Compilation of Codes, Rules and Regulations of the State of New York.

The sanitary sewer (leaching system) shall be designed and signed by a registered professional engineer. The package shall be submitted to NYSDOH for review and approval prior to start of work.

At least one percolation test and one deep hole test shall be performed in the location of the primary absorption field. New York State Department of Health shall be notified of the test time and location at least 7 days prior to testing.

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Delivery and Storage

1.6.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.6.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.6.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

1.6.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Carry, do not drag, pipe to trench.

1.7 DRAWINGS

a. Submit Installation Drawings showing complete detail, both plan and side view details with proper layout and elevations.

b. Submit As-Built Drawings for the complete sanitary sewer system showing complete detail with all dimensions, both above and below grade, including invert elevation.

c. Sign and seal As-Built Drawings by a Professional Surveyor and Mapper. Include the following statement: "All potable water lines crossed by sanitary hazard mains are in accordance with the permitted utility separation requirements."

1.8 EXISTING CONDITIONS

Submit drawings of existing conditions, after a thorough inspection of the area by the Contractor in the presence of the Contracting Officer. Details shall include the environmental conditions of the site and adjacent areas. Submit copies of the records for verification before starting work.

1.9 INSTALLER QUALIFICATIONS

Install specified materials by a licensed underground utility contractor licensed for such work in the state where the work is to be performed. Installing Contractor's License shall be current and be state certified or state registered.

PART 2 PRODUCTS

2.1 DISTRIBUTION BOX

For gravity distribution, the maximum length of absorption lines used in conjunction with gravity distribution shall be 18.3 m.

For accessibility, the distribution box shall be located and have a removable cover not more than 300 mm below grade. Where, due to site conditions, a distribution box needs to be greater than 300 mm below the surface, an extension collar shall be installed to within 300 mm of the surface. Outlets from the distribution box shall be at the same level to ensure the even distribution of flow. To minimize frost action and reduce the possibility of movement once installed, distribution boxes shall be set on a bed of sand or pea gravel at least 300 mm thick. The drop between inlet and outlet inverts shall be at least 50 mm. A baffle is required at the inlet side of the box when the slope from the septic tank to the box exceeds 12.7 per 305 mm or when siphon dosing is used. There shall be a minimum 50 mm clearance between the inverts of the outlets and the bottom of the box to prevent short-circuiting and reduce solids carry-over. Distribution boxes may be constructed in place or purchased prefabricated. Concrete shall have a minimum compressive strength of 17,237 kPa at 28 day set. Prefabricated boxes may be constructed of concrete.

2.2 SEPTIC TANK

Contractor shall provide one precast concrete septic tank with ability to hold 3,785 L. The following applies to all septic tanks regardless of material.

The septic tank shall have a minimum liquid depth of 750 mm. The maximum depth for determining the allowable design volume of a tank shall be 1500 mm. Deeper tanks provide extra sludge storage, but no credit shall be given toward design volume. The minimum distance between the inlet and outlet shall be 1.83 m. The tank shall meet the minimum surface area requirement for the specific design volume specified in Table 3. The effective length of rectangular tanks should not be less than 2 nor greater than 4 times the effective width. Tanks shall be watertight, constructed of durable material not subject to corrosion, decay, frost damage, or cracking. After installation, all septic tanks shall be able to support at least 1,465 kg per square meter. Tanks with a liquid depth of 1200 mm or more shall have a top opening with a minimum of 500 mm in the shortest dimension to allow entry into the tank. A tank with a liquid depth less than 1200 mm shall have a top opening that is at least 300 mm in the shortest dimension. Tank shall have inlet and outlet baffles, sanitary tees or other devices to

prevent the passage of floating solids and to minimize disturbance of settled sludge and floating scum by sewage entering and leaving the tank. Outlet designs such as gas deflection baffles are strongly recommended in all tanks. Inlet and outlet baffles shall extend a minimum of 300 mm and 350 mm respectively, below the liquid level in the tank with a liquid depth of less than 1000 mm, and 400 and 450 mm respectively, in a tank with a liquid depth of 1000 mm or greater. The distance between the outlet baffle and the outlet shall not exceed 150 mm. Baffles shall be constructed of a durable material not subject to corrosion, decay or cracking. There shall be a minimum of 25 mm clearance between the underside of the top of the tank and the top of all baffles, partition and/or tees to permit venting of tank gases. Multi-chamber and multi-tank systems shall also be designed to permit the venting of tank gases. The tank shall be placed on at least a 75 mm bed of sand or pea gravel to provide for proper leveling and bearing.

Additional instructions provided by the manufacturer shall also be followed. There shall be a minimum drop in elevation of 50 mm between the inverts of the inlet and outlet pipes.

2.2.1 Concrete Tanks

Concrete shall have a minimum compressive strength of 17,237 kPa at 28 days set; 20,684 kPa concrete is required as a minimum. Wall thickness shall be a minimum of 75 mm, unless the design has been certified by a New York licensed professional engineer as complying with all appropriate requirements for thin-wall construction. All walls, bottom and top shall contain reinforcing to assure support for 14 kPa. Joints shall be sealed such that the tank is watertight; joints below the liquid level shall be tested for watertightness prior to backfilling.

2.3 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements specified below.

2.3.1 Ductile Iron Gravity Sewer Pipe and Associated Fittings

2.3.1.1 Ductile Iron Gravity Pipe and Fittings

Ductile iron pipe shall conform to ASTM A 746, Thickness Class 52. Fittings shall conform to AWWA C110 or AWWA C153. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved by the Contracting Officer, for push-on joint. Fittings shall have strength at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the joints specified hereinafter. Pipe and fittings shall have cement-mortar lining conforming to AWWA C104, standard thickness.

2.3.1.2 Ductile Iron Gravity Joints and Jointing Materials

Pipe and fittings shall have push-on joints or mechanical joints, except as otherwise specified in this paragraph. Mechanical joints only shall be used where indicated. Push-on joint pipe ends and fitting ends, gaskets, and lubricant for joint assembly shall conform to AWWA C111. Mechanical joint requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111.

2.3.2 ABS Composite Plastic Piping

2.3.2.1 ABS Composite Plastic Pipe and Fittings

ASTM D 2680.

2.3.2.2 Jointing Materials for ABS Composite Plastic Piping

Solvent cement and primer shall conform to ASTM D 2680.

2.3.3 ABS Solid-Wall Plastic Piping

2.3.3.1 ABS Solid-Wall Plastic Pipe and Fittings

ASTM D 2751, SDR 35, with ends suitable for either solvent cement joints or elastomer joints.

2.3.3.2 ABS Solid-Wall Plastic Joints and Jointing Materials

Solvent cement for solvent cement joints shall conform to ASTM D 2235. Elastomeric joints shall conform to ASTM D 3212. Gaskets for elastomeric joints shall conform to ASTM F 477.

2.3.4 PVC Plastic Gravity Sewer Piping

2.3.4.1 PVC Plastic Gravity Pipe and Fittings

ASTM D 3034, SDR 35, or ASTM F 949 with ends suitable for elastomeric gasket joints.

2.3.4.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

2.4 CONCRETE MATERIALS

2.4.1 Cement Mortar

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.4.2 Portland Cement

Portland cement shall conform to ASTM C 150, Type II V for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.4.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94/C 94M, compressive strength of 28 MPa at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 17 MPa minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.5 MISCELLANEOUS MATERIALS

2.5.1 Metal Items

2.5.1.1 Septic Tank Piping

Cast iron soil pipe and fittings.

2.5.2 Sewage Absorption Field Materials

a. Pipe shall be perforated PVC truss pipe conforming to ASTM D 1784 with minimum cell Class 12454B or 12454C. Solvent cement joints shall meet applicable requirements of ASTM D 2680.

2.6 REPORTS

Submit Test Reports. Compaction and density test shall be in accordance with Section 02300 EARTHWORK. Submit Inspection Reports for daily activities during the installation of the sanitary system. Information in the report shall be detailed enough to describe location of work and amount of pipe laid in place, measured in linear meters.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in the following paragraphs SPECIAL REQUIREMENTS.

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 1.5 m from the building, unless otherwise indicated. Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 3 m to a water main or service line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 3 m on each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 0.9 m, horizontal distance, to the water line.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 02300 EARTHWORK.

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell or groove ends in the upgrade direction. Adjust spigots in bells and tongues in grooves to give a uniform space all around. Blocking or wedging between bells and spigots or tongues and grooves will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or

bulkheads. Provide batterboards not more than 7.50 m apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose. Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D 2680; saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

3.1.2 Special Requirements

3.1.2.1 Installation of Ductile Iron Gravity Sewer Pipe

Unless otherwise specified, install pipe and associated fittings in accordance with paragraph GENERAL REQUIREMENTS FOR INSTALLATION OF PIPELINES of this section and with the requirements of AWWA C600 for pipe installation and joint assembly.

- a. Make push-on joints with the gaskets and lubricant specified for this type joint and assemble in accordance with the applicable requirements of AWWA C600 for joint assembly. Make mechanical-joints with the gaskets, glands, bolts, and nuts specified for this type joint and assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of Appendix A to AWWA C111.

3.1.2.2 Installation of ABS Composite Plastic Piping

Install pipe and fittings in accordance with paragraph GENERAL REQUIREMENTS FOR INSTALLATION OF PIPELINES of this section and with the recommendations of the plastic pipe manufacturer. Make joints with the primer and solvent cement specified for this joint and assemble in accordance with the recommendations of the pipe manufacturer. Handle solvent cement in accordance with ASTM F 402.

3.1.2.3 Installation of ABS Solid-Wall Plastic Piping

Install pipe and fittings in accordance with paragraph GENERAL REQUIREMENTS FOR INSTALLATION OF PIPELINES of this section and with the recommendations of the plastic pipe manufacturer. Make solvent cement joints with the solvent cement previously specified for this type joint. Make elastomeric joints with the gaskets specified for this type joint and assemble in accordance with the recommendations of the pipe manufacturer. Handle solvent cement in accordance with ASTM F 402.

3.1.2.4 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph GENERAL REQUIREMENTS FOR INSTALLATION OF PIPELINES of this section and with the requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.3 Concrete Work

Cast-in-place concrete is included in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The pipe shall be supported on a concrete cradle, or

encased in concrete where indicated or directed.

3.1.4 Miscellaneous Construction and Installation

3.1.4.1 Metal Work

Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

3.1.5 Absorption Trenches

Trench locations and depths should be marked by stakes before the trenches are excavated. The natural surface shall not be significantly disturbed. If the site is regraded or similarly disturbed, the soil shall be allowed to stabilize and new percolation tests conducted. The trench depth shall be as shallow as possible, but not less than 450 mm. At least 150 mm of aggregate is placed below the distribution line and 50 mm above the line. The earth cover over the aggregate should not exceed 300 mm in order to enhance natural aeration and nitrogen uptake by plant life. Trenches shall be excavated to design depth with bottoms practically level. Heavy equipment shall be kept away from the field because the weight may permanently alter soil characteristics due to compaction, cause trench cave-ins, and/or misalign and break pipe. Trench bottoms are to be raked and immediately covered with at least 150 mm of aggregate. Any smeared surfaces on the trench walls are to be raked. Distributor lines are carefully placed on the aggregate and covered with aggregate to a depth of at least 50 mm over the top of the pipe. Additional aggregate may be required to bring the top of the aggregate to within 150 to 300 mm of the surface. In gravity distribution systems, the pipe shall be carefully sloped at between 1.59 mm and 0.79 mm. Grades shall be determined by an engineer's level, transit or carpenter's level. After the upper aggregate is placed, the geotextile, untreated building paper, hay or straw is to be immediately installed and the trench backfilled with native soil. If the trenches cannot be immediately backfilled, temporarily cover trenches with an impervious material such as treated building paper to prevent sidewall collapse and siltation into the aggregate. The earth backfill is to be mounded slightly above the original ground level to allow for settling and after settlement the entire area should be graded without the use of heavy equipment and seeded with grass.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Tests for Nonpressure Lines

Check each straight run of pipeline for gross deficiencies by holding a

light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line. When pressure piping is used in a nonpressure line for nonpressure use, test this piping as specified for nonpressure pipe.

3.2.2.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

- a. Infiltration tests and exfiltration tests: Perform these tests for sewer lines made of the specified materials, not only concrete, in accordance with ASTM C 969M. Make calculations in accordance with the Appendix to ASTM C 969M.
- b. Low-pressure air tests: Perform tests as follows:
 - (1) Ductile-iron pipelines: Test in accordance with the applicable requirements of ASTM C 924M. Allowable pressure drop shall be as given in ASTM C 924M. Make calculations in accordance with the Appendix to ASTM C 924M.
 - (2) ABS composite plastic pipelines: Test in accordance with the applicable requirements of UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.
 - (3) PVC plastic pipelines: Test in accordance with UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

-- End of Section --